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Impact of human milk oligosaccharide supplementation on learning and memory ability of piglets in 8-arm radial maze

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Human milk oligosaccharides (HMOs) are the third most abundant carbohydrates in human milk after lactose and lipids(1). While HMOs are known for various health benefits, their effects on cognitive function and brain development remain debated. This study investigates whether individual or combined supplementation of HMOs improves cognitive behaviours and stress responses in piglets, an ideal animal model for human infants. Sixty-four domestic male piglets, 3 days old, were randomly assigned to 1 of 4 groups and received pig milk replacer supplemented with different HMOs from postnatal day (PND) 3 to 38. Treatment groups included: Group 1: 2′-Fucosyllactose (2′-FL, 1.8 g/L; n = 14); Group 2: 3′/6′-Sialyllactose (3′/6′-SL in a 1:2.5 ratio, 1.8 g/L, n = 16); Group 3: combined HMOs (cHMOs, 70% 2′-FL and 30% 3'/6'-SL in a 1:2.5 ratio, at 1.8 g/L, n = 16), and Control (methyl cellulose, 1.8 g/L; n = 14). Cognitive performances were assessed using our published 8-arm radial maze(2), incorporating easy task (PND 23–27) and difficult task (PND 29–33) visual cues. Stress responses were assessed by measuring serum cortisol concentrations via ELISA. All data were analysed using SPSS (SPSS Inc., Chicago, IL) with significance set at *$p < 0.05$. The research protocol was approved by the ACECs of Charles Sturt University (A23566). Results showed that on the third day of behaviour testing, piglets in the cHMO group made significantly fewer total mistakes than the controls in the easy task ($p < 0.05$), whereas the 2′-FL group exhibited significantly fewer total mistakes in the difficult task ($p < 0.05$). Serum cortisol levels were not significantly different between the groups ($p > 0.05$). The findings suggest that HMOs supplementation may enhance cognitive function under both challenging and non-challenging conditions without affecting physiological stress markers, highlighting their potential role in supporting brain development during early life.

References

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